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# A TABLE OF ATOMIC WEIGHTS

## of Seventy-seven Elements.

*Compiled in April,* 1902, *from the most Recent Data.*

By Theodore William Richards.

| Name. | Symbol. | Atomic Weight. | Name. | Symbol. | Atomic Weight. |
|---|---|---|---|---|---|
| Aluminium . . | Al | 27.1 | Molybdenum . . | Mo | 96.0 |
| Antimony . . . | Sb | 120.0 | Neodymium . . | Nd | 143.6 |
| Argon . . . . | A | 39.92 | Neon . . . . | Ne | 19.94 |
| Arsenic . . . . | As | 75.0 | Nickel . . . . | Ni | 58.71 |
| Barium . . . . | Ba | 137.43 | Niobium . . . | Nb = Cb | 94. |
| Beryllium . . . | Be = Gl | 9.1 | Nitrogen . . . | N | 14.04 |
| Bismuth . . . | Bi | 208. | Osmium . . . | Os | 190.8 |
| Boron . . . . | B | 11.0 | Oxygen (standard) | O | 16.000 |
| Bromine . . . | Br | 79.955 | Palladium . . . | Pd | 106.5 |
| Cadmium . . . | Cd | 112.3 | Phosphorus . . | P | 31.0 |
| Cæsium . . . | Cs | 132.88 | Platinum . . . | Pt | 195.2 |
| Calcium . . . | Ca | 40.13 | Potassium . . . | K | 39.14 |
| Carbon . . . . | C | 12.001 | Praseodymium . | Pr | 140.5 |
| Cerium . . . . | Ce | 140. | Rhodium . . . | Rh | 103.0 |
| Chlorine . . . | Cl | 35.455 | Rubidium . . . | Rb | 85.44 |
| Chromium . . | Cr | 52.14 | Ruthenium . . | Ru | 101.7 |
| Cobalt . . . . | Co | 59.00 | Samarium ? . . | Sm | 150. |
| Columbium . . | Cb = Nb | 94. | Scandium . . . | Sc | 44. |
| Copper . . . . | Cu | 63.60 | Selenium . . . | Se | 79.2 |
| " Didymium " . | Nd + Pr | 142.± | Silicon . . . . | Si | 28.4 |
| Erbium . . . . | Er | 166. | Silver . . . . | Ag | 107.93 |
| Fluorine . . . | F | 19.05 | Sodium . . . . | Na | 23.05 |
| Gadolinium . . | Gd | 156. ? | Strontium . . . | Sr | 87.68 |
| Gallium . . . | Ga | 70.0 | Sulphur . . . | S | 32.065 |
| Germanium . . | Ge | 72.5 | Tantalum . . . | Ta | 183. |
| Glucinum . . . | Gl = Be | 9.1 | Tellurium . . . | Te | 127.5 ? |
| Gold . . . . . | Au | 197.3 | Terbium ? . . . | Tb | 160. |
| Helium . . . . | He | 3.96 | Thallium . . . | Tl | 204.15 |
| Hydrogen . . . | H | 1.0076 | Thorium ? . . . | Th | 233. ? |
| Indium . . . . | In | 114. | Thulium ? . . . | Tu | 171. ? |
| Iodine . . . . | I | 126.85 | Tin . . . . . | Sn | 119.0 |
| Iridium . . . . | Ir | 193.0 | Titanium . . . | Ti | 48.17 |
| Iron . . . . . | Fe | 55.88 | Tungsten . . . | W | 184. |
| Krypton . . . | Kr | 81.7 | Uranium . . . | U | 238.5 |
| Lanthanum . . | La | 138.5 | Vanadium . . . | V | 51.4 |
| Lead . . . . | Pb | 206.92 | Xenon . . . . | X | 128. |
| Lithium . . . | Li | 7.03 | Ytterbium . . . | Yb | 173. |
| Magnesium . . | Mg | 24.36 | Yttrium . . . | Yt | 89.0 |
| Manganese . . | Mn | 55.02 | Zinc . . . . . | Zn | 65.40 |
| Mercury . . . | Hg | 200.0 | Zirconium . . . | Zr | 90.6 |

## NOTE.

THE accompanying table of atomic weights is but little changed since last year. Cæsium is made 132.88 instead of 132.9; calcium, 40.13 instead of 40.1; iron, 55.88 instead of 55.9; hydrogen, 1.0076 instead of 1.0075; and nickel, 58.71 instead of 56.70. The value for cæsium is due to some work, as yet unpublished, of Richards and Archibald, and that for calcium is increased in accuracy because the recent investigation of Hinrichsen * supports the less recent Harvard value.† The other very small changes are due simply to slight differences in the interpretation of data already well known. The decimal might have been omitted from palladium, because this element may still be a whole unit in doubt; but it has been retained as a compromise.

The differences between the present table, that of the German Committee,‡ and that of F. W. Clarke,§ are diminishing year by year. Nevertheless to as many as twenty-eight elements out of the seventy-seven are given values in these three tables differing among themselves by over one tenth of a per cent; namely, the atomic weights of antimony, bismuth, cerium, columbium, fluorine, gadolinium, germanium, helium, hydrogen, lanthanum, magnesium, mercury, neon, osmium, palladium, platinum, potassium, samarium, scandium, selenium, tantalum, tellurium, thorium, thulium, tin, titanium, uranium, and zirconium. To this list of uncertain elements should be added erbium, gallium, glucinum, indium, terbium, tungsten, ytterbium, upon which the three tables agree only because of lack of data upon which to base a disagreement. Thus nearly half of the elements are still in doubt by at least one part in a thousand. This circumstance is not so much a reproof to the many earnest workers upon the subject, as an evidence of the great difficulty of some of the problems involved.

Three of the elements given in the list above should not properly be included among the uncertain values, namely, hydrogen, magnesium, and potassium. The first finds its way into the list because of the disregard of significant figures by the German Committee, and the second chiefly because Clarke has included in his calculation work upon magnesic oxide undoubtedly erroneous on account of the presence of included gases. || The case of potassium is somewhat peculiar; for in spite of the great wealth of data concerning this element, Clarke assigns to it the value 39.11, while the German Committee chooses 39.15. The low value is chiefly due to very unsatisfactory data concerning potassic iodide. To me it seems that the most recent work of Stas is far more satisfactory than his earlier work or than the work of any one else, hence the value 39.14 has been assigned to potassium in the present table since its first publication. Careful analyses by E. H. Archibald and myself confirm this conclusion.

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* Hinrichsen, Zeitschr. phys. Chem., **39**, 311 (1901).

† Richards, Journ. Am. Chem. Soc., **22**, 72 (1900), also **24**, 374 (1902).

‡ Landolt, Ostwald, and Seubert, Extra insertion in Berichte d. d. ch. Ges. 1902. Heft 1.

§ F. W. Clarke, Journ. Am. Chem. Soc., **24**, 201 (1902).

|| Richards and Rogers, These Proceedings, **28**, 209 (1893).